



Advancing Science and Innovation in Healthcare Research

Health Horizons

Edited by
Debasmita Bhattacharya
Prabir Kumar Das
Samapika Das Biswas



ADVANCING SCIENCE AND INNOVATION IN HEALTHCARE RESEARCH

Health Horizons

Edited by

DEBASMITA BHATTACHARYA

*Department of Basic Science and Humanities, Institute of Engineering & Management,
University of Engineering and Management, Kolkata, West Bengal, India*

PRABIR KUMAR DAS

*Department of Basic Science and Humanities, Institute of Engineering & Management,
University of Engineering and Management, Kolkata, West Bengal, India*

SAMAPIKA DAS BISWAS

*Department of Basic Science and Humanities, Institute of Engineering & Management,
University of Engineering and Management, Kolkata, West Bengal, India*



ACADEMIC PRESS

An imprint of Elsevier

elsevier.com/books-and-journals

Academic Press is an imprint of Elsevier

125 London Wall, London EC2Y 5AS, United Kingdom
50 Hampshire Street, 5th Floor, Cambridge, MA 02139, United States

Copyright © 2025 Elsevier Inc. All rights are reserved, including those for text and data mining, AI training, and similar technologies.

Publisher's note: Elsevier takes a neutral position with respect to territorial disputes or jurisdictional claims in its published content, including in maps and institutional affiliations.

For accessibility purposes, images in electronic versions of this book are accompanied by alt text descriptions provided by Elsevier. For more information, see <https://www.elsevier.com/about/accessibility>.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the publisher. Details on how to seek permission, further information about the Publisher's permissions policies and our arrangements with organizations such as the Copyright Clearance Center and the Copyright Licensing Agency, can be found at our website: www.elsevier.com/permissions.

This book and the individual contributions contained in it are protected under copyright by the Publisher (other than as may be noted herein).

Notices

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our understanding, changes in research methods, professional practices, or medical treatment may become necessary.

Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds, or experiments described herein. In using such information or methods they should be mindful of their own safety and the safety of others, including parties for whom they have a professional responsibility.

To the fullest extent of the law, neither the Publisher nor the authors, contributors, or editors, assume any liability for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions, or ideas contained in the material herein.

ISBN: 978-0-443-33351-4

For Information on all Academic Press publications visit our website at
<https://www.elsevier.com/books-and-journals>

Publisher: Megan Ball

Acquisitions Editor: Linda Buschman

Editorial Project Manager: Kathy Padilla

Production Project Manager: Punithavathy Govindaradjane

Cover Designer: Miles Hitchen



Typeset by Aptara, New Delhi, India

Contents

Contributors xiii

Preface xvii

1. Introduction to modern technological advancement for supervising human health 1

Dibyajit Lahiri, Saikat Mazumder, Debasmita Bhattacharya and Moupriya Nag

- 1.1 Introduction 1
- 1.2 Multiomics and healthcare: Applications in precision health 3
- 1.3 Stem cells and tissue regeneration three dimensional bioprinting 8
- 1.4 Industry 4.0 and health care: The smart talk 15
- 1.5 Artificial intelligence and health care: Need of the hour 16
- 1.6 Internet of things and health care: The necessary coordination 19
- 1.7 Blockchain and health care: The upcoming dynamism 21
- 1.8 Data science and analytics in advancing health care 22
- 1.9 Conclusion 27
- References 28

2. Applying systems biology frameworks in the investigation of chronic infectious diseases 39

Subhamoy Banerjee

- 2.1 Introduction 39
- 2.2 Biology of infection 40
- 2.3 Modeling of host–pathogen interaction 42
- 2.4 Multiomics data analysis for prediction of infection 45
- 2.5 Machine learning-based prediction 46
- 2.6 Conclusion 47
- References 47

3. Systems biology approach in the detection of neuronal disorders 51

Dhruv Rao, Siddhant Yadav, Nabh Chandra, Tisha Muthamma CM, Yuvaraj Sivamani, Kiran Sree Pokkuluri and Sumitha Elayaperumal

- 3.1 Introduction 51
- 3.2 Network analysis of neuronal system 56
- 3.3 Computational approaches 58
- 3.4 Role of epigenetics in neuronal disorders 66
- 3.5 Neuroinflammation and immune system interactions 71
- 3.6 Machine learning and predictive models for diagnosis (of neuronal disorders) 74
- 3.7 Microbiome-brain axis in neurodegenerative diseases 78
- 3.8 Neurodegenerative diseases and mitochondrial dysfunction 84
- 3.9 Single-cell analysis for neuronal heterogeneity 88
- 3.10 System pharmacology for targeted therapies 95
- References 97

4. Systems biology approach in the detection of cancer 107

Subhrojyoti Ghosh, Atharva Anand Mahajan, Swarnadip Ghosh, Prakriti Seth, Soma Prasad Sahoo, Anushka Samant, Shrimanti Das, Souvadra Das, Anuvab Dey and Gauri Panzade

- 4.1 Introduction: Systems biology in cancer diagnosis—A new frontier 107
- 4.2 High-throughput technologies: Unraveling the cancer omics 108
- 4.3 Biomarker discovery in cancer: A systems biology approach 111
- 4.4 Network and pathway analysis in cancer systems biology 113



Chapter 2 - Applying systems biology frameworks in the investigation of chronic infectious diseases

Subhamoy Banerjee

[Show more](#) ✓

Outline | Share Cite

<https://doi.org/10.1016/B978-0-443-33351-4.00001-5> ↗

[Get rights and content](#) ↗

Abstract

Infectious diseases account for nearly 15 million deaths worldwide each year, a number expected to rise with climate change and increasing antibiotic resistance. Recent viral strains, such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), have added to this toll, with survivors often facing new health challenges and vulnerability to secondary infections. Understanding the infection as a host–pathogen interaction has proven challenging due to the complexity of microbial mutations, which can obscure early diagnosis. Traditional methods rely on symptoms and blood tests, which may not capture evolving infection dynamics. High-throughput techniques and omics data now allow for a systems approach to infectious disease research, aiding in the identification of potential drug targets. This chapter examines molecular interactions in infections, exploring optimization, dynamics, game theory, and machine learning to model these interactions and predict disease patterns. It also highlights the discovery of treatable host traits and biomolecules as therapeutic targets.

References (0)

Cited by (0)

[View full text](#)



All content on this site: Copyright © 2026 Elsevier B.V., its licensors, and contributors. All rights are reserved, including those for text and data mining, AI training, and similar technologies. For all open access content, the relevant licensing terms apply.

